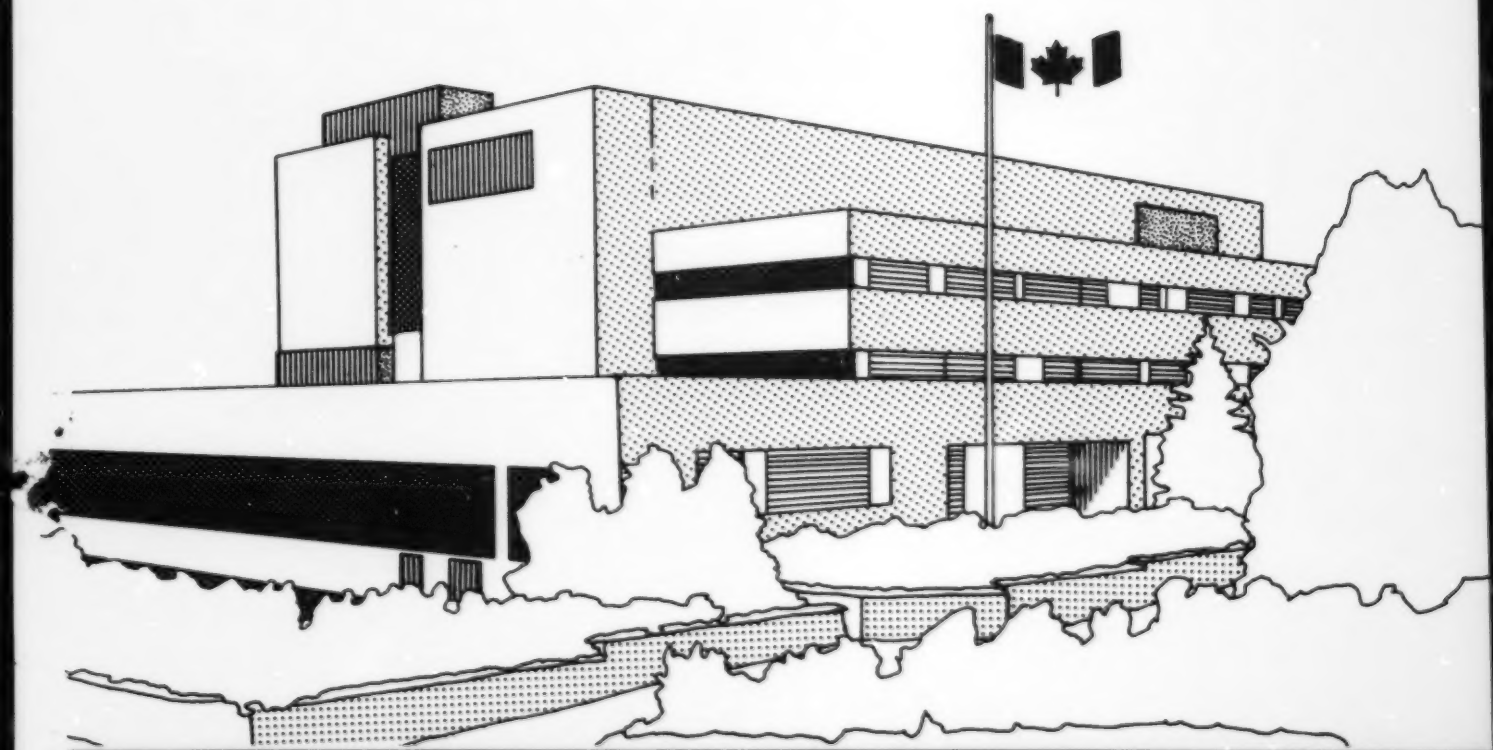
Results of forest insect and disease surveys in the NORTH CENTRAL REGION of Ontario, 1988

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

H. J. Evans and S. Melbourne

Miscellaneous Report No. 83



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92-05260/

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE NORTH CENTRAL REGION OF ONTARIO 1988

(FOREST DISTRICTS: ATIKOKAN, THUNDER BAY, NIPIGON, GERALDTON AND TERRACE BAY)

H.J. EVANS and S. MELBOURNE

FORESTRY CANADA

ONTARIO REGION

GREAT LAKES FORESTRY CENTRE

1989

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SURVEY HIGHLIGHTS

This report is a summary of forest insect and disease surveys in the North Central Region of Ontario in 1988.

The ubiquitous spruce budworm continued to be the most serious pest in the region. Although the outbreak area declined in size in 1988, egg-mass counts and forecasts for 1989 increased. Forest tent caterpillar infestations were found in four of five districts and Bruce spanworm continued to be a major defoliator. New infestations were reported for linden looper and greenstriped mapleworm. The incidence of eastern pine shoot borer increased.

Damage to balsam poplar by poplar leaf diseases recurred and a similar disorder of white birch caused serious foliar damage in some areas. Other diseases of importance in 1988 included Armillaria root rot, western gall rust, spruce needle rust, Scleroderris canker and ink spot of aspen. Windstorms during the year were responsible for extensive blowdown in some areas.

Jack pine cone and plantation pests were targeted for particular attention in 1988. Other activities during the year were gypsy moth pheromone trapping, pinewood nematode collections and continued monitoring of the Acid Rain National Early Warning System (ARNEWS) plots.

The format for this report remains unchanged from that of 1987. Insects and diseases are categorized as follows:

Major Insects or Diseases

capable of causing serious injury to or death of living trees or shrubs

Minor Insects or Diseases

capable of causing sporadic or localized injury but not usually a threat to living trees or shrubs

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

1) those that are of minor importance and have not been known to cause serious damage to forest trees

2) those that are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1988.

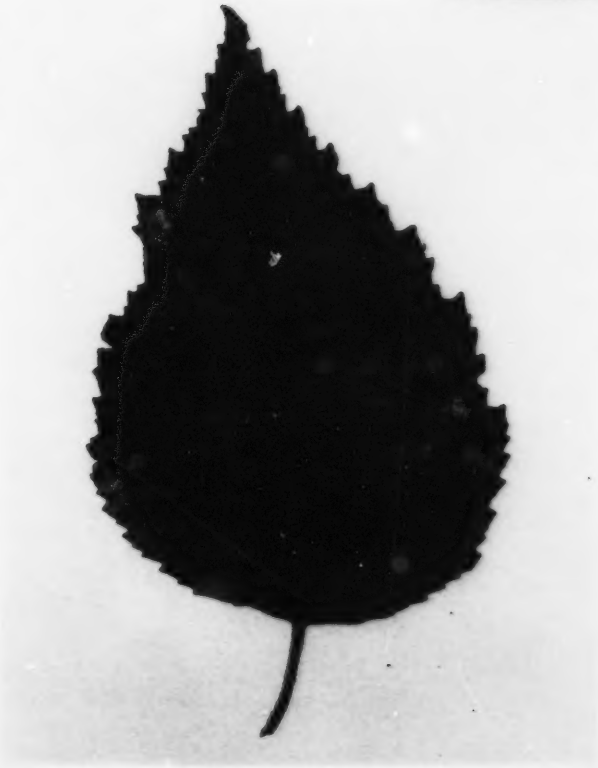
The authors wish to acknowledge the assistance and cooperation of the Ontario Ministry of Natural Resources (OMNR), forest industries and other agencies and individuals during the 1988 field season.

Hugh Evans

Simon Melbourne

Frontispiece

Defoliation of white birch (*Betula papyrifera* Marsh.) by the linden looper (*Erannis tiliaria* [Harr.])



Closeup of damage caused by birch leafminer (*Fenusa pusilla* [Lep.])

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INSECTS

Major Insects

Spruce Budworm, **Choristoneura fumiferana** (Clem.)

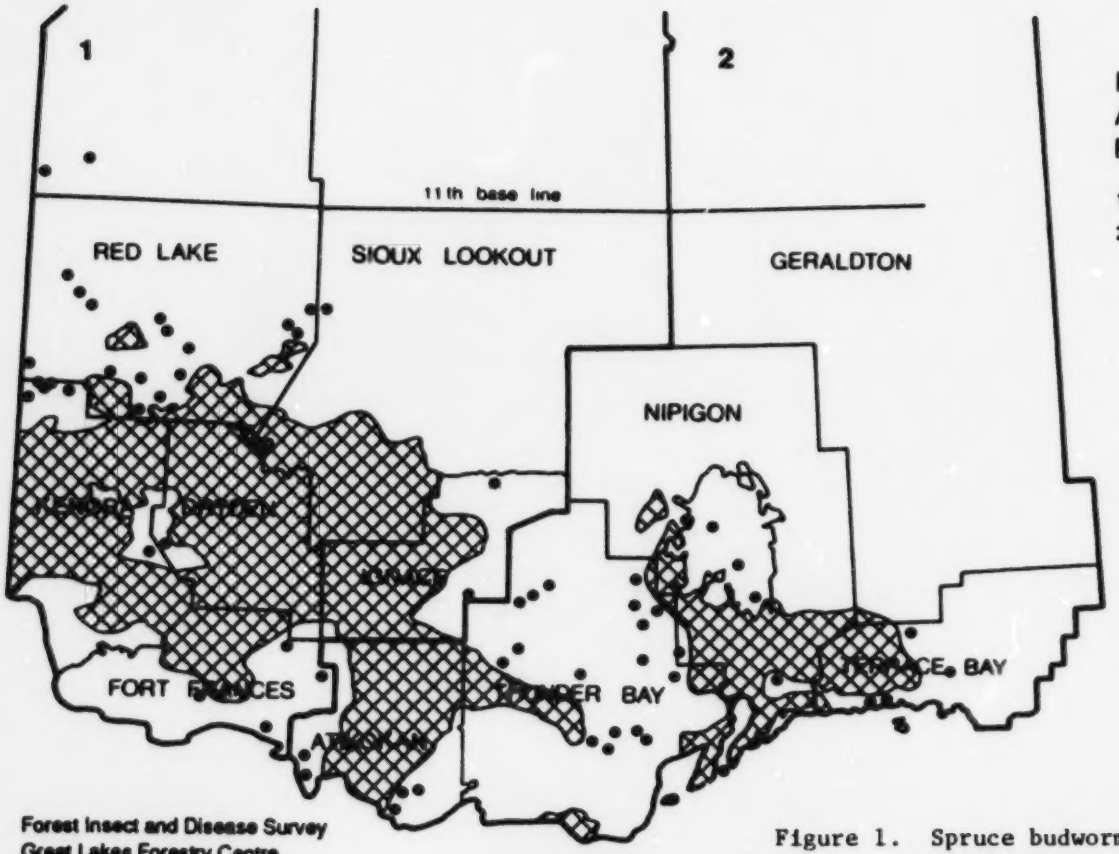
The overall spruce budworm situation in Ontario was highlighted by a pronounced decline in the total area of moderate-to-severe defoliation. This area, all of which is in the Northwestern and North Central regions, was reduced from 7,189,763 ha in 1987 to 5,224,734 ha in 1988. Despite these declines, two major bodies of infestation and a number of smaller areas persist. The larger area (3,892,027 ha) extends from the Manitoba border across the Northwestern Region to the Atikokan and Thunder Bay districts. The smaller area (820,249 ha) is centered south of Lake Nipigon and includes parts of the Thunder Bay, Nipigon, Terrace Bay and Geraldton districts. The numerous smaller infestations around and between the two main areas range in size from a few hectares up to an expanse of 52,516 ha in the Sibley Peninsula area of Thunder Bay District (Fig. 1).

The major portion of the previously mentioned decline occurred in the North Central Region, where the outbreak area was reduced by approximately 50%. Aerial and ground surveys revealed that abatements in the areas of moderate-to-severe damage were evident in all five districts of the region. The most outstanding reduction was in the Thunder Bay District, where the infested area shrank from 1,101,963 ha in 1987 to 376,395 ha in 1988 (Fig. 2 and Table 1). Although significant declines in the outbreak areas were recorded, the actual damage within the infested areas intensified somewhat, and delineated areas of damage were more pronounced. This was particularly noticeable on white spruce (**Picea glauca** [Moench] Voss), which generally sustained somewhat heavier damage than did balsam fir (**Abies balsamea** [L.] Mill.). Damage to black spruce (**Picea mariana** [Mill.] B.S.P.) was comparatively light.

OMNR conducted aerial spraying over a total area of 14,023 ha in the Thunder Bay (4,878 ha) and Nipigon (9,145 ha) districts from 30 May to 16 June, 1988. The biological insecticide **Bacillus thuringiensis** (B.t.) was used in all areas. Results were variable, ranging from good to poor, but generally the areas sprayed early received the best protection. A report specifically devoted to the assessment of the spray program will be published at a later date.

Larval development progressed favorably and was not impeded by adverse weather conditions as in 1987. Likewise, pupal survival was good, and this gave rise to an increased number of moths in some areas. This was observed in the town of Nipigon and recorded by means of moth collections at French Lake, Atikokan District, and near the city of Thunder Bay. Subsequently, egg-mass survey results showed a dramatic increase in egg-mass densities at many locations. A comparison of egg-

NORTHWESTERN ONTARIO



PROVINCIAL ADMINISTRATIVE REGIONS :

1. NORTHWESTERN
2. NORTH CENTRAL

Figure 1. Spruce budworm *Choristoneura fumiferana* (Clem.)

Areas within which moderate-to-severe defoliation occurred in Northwestern Ontario in 1988 ⊠ or ●

NORTH CENTRAL REGION

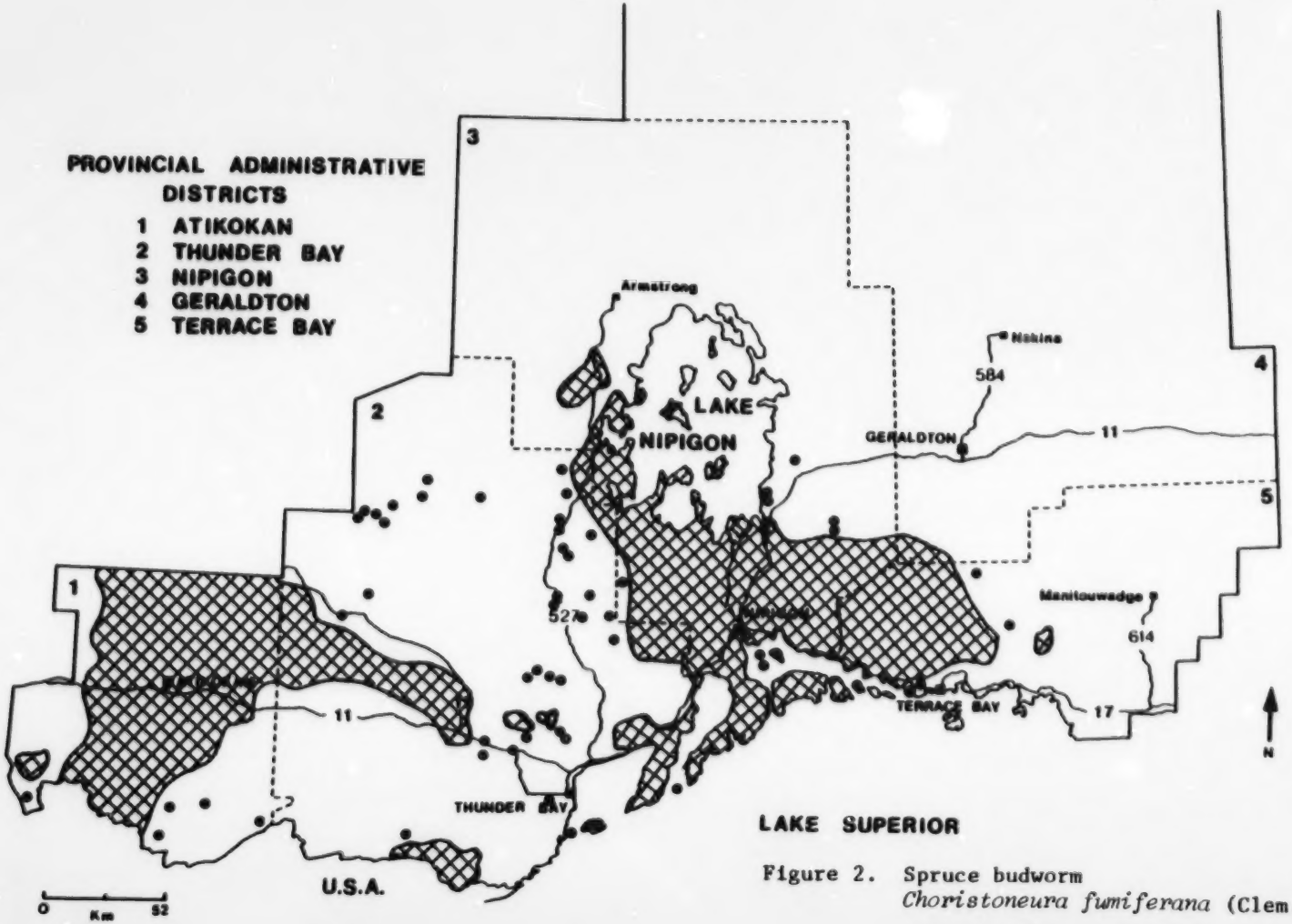


Figure 2. Spruce budworm *Choristoneura fumiferana* (Clem.)

Areas within which moderate-to-severe defoliation occurred in 1988 ⊠ or •

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mass densities at the same 154 locations in 1987 and 1988 indicates that there is an overall increase of 85% in this region (ranging from 6% in Atikokan District to 729% in Geraldton District) (Table 2). In all, 219 locations were sampled for eggs across the region (see Appendix and Fig. 3). On the basis of these results, it is expected that infestations will intensify and defoliation will increase within most of the area affected in 1988. There are a number of moderate and severe forecasts for areas outside the current outbreak boundaries and some expansion of the infestation may occur in their direction. This is most evident along the north and east fronts of the infestation in Nipigon, Geraldton and Terrace Bay districts and also in the southeastern corner of Atikokan District.

Table 1. Gross area (ha) of current moderate-to-severe defoliation by spruce budworm in the North Central Region from 1985 to 1988.

	Area of moderate-to-severe defoliation (ha)			
District	1985	1986	1987	1988
Atikokan	918,500	890,691	808,508	578,464
Geraldton	683,178	400,486	211,954	13,956
Nipigon	1,125,751	985,961	987,526	605,741
Thunder Bay	2,315,563	2,005,718	1,101,963	376,395
Terrace Bay	1,168,400	1,023,773	528,555	260,393
Total	5,042,992	5,306,629	3,638,506	1,834,949

Table 2. Comparison of spruce budworm egg-mass densities in the North Central Region in 1987 and 1988.

District	No. of locations sampled	No. of locations with increases	Average egg-mass density per 9.29 m^2		Change (%)
			1987	1988	
Atikokan	15	10	392.9	418.1	+6
Geraldton	17	15	13.1	108.6	+729
Nipigon	26	15	166.6	505.2	+203
Terrace Bay	32	19	40.2	71.6	+78
Thunder Bay	64	32	109.5	175.6	+60
Over all	154	91	121.7	225.8	+85

NORTH CENTRAL REGION

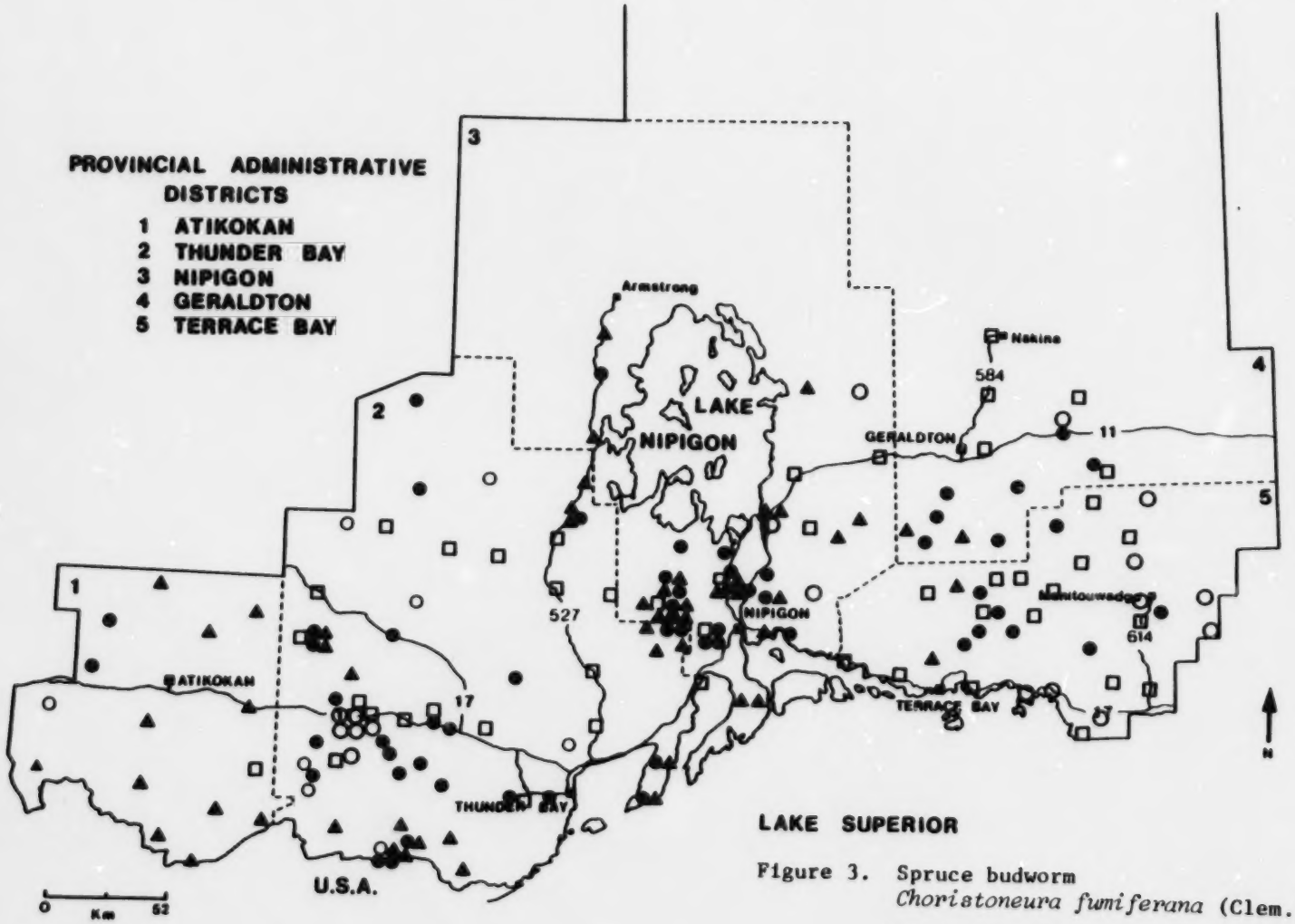

Figure 3. Spruce budworm *Choristoneura fumiferana* (Clem.)

Infestation forecasts for 1989 based on egg-mass densities in 1988

Nil ○ Moderate ●
Light □ Severe ▲

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Surveys were conducted in the latter part of the field season to record areas within which balsam fir whole-tree and top mortality occurred as the result of spruce budworm feeding damage. The total area thus affected was 870,069 ha, an increase of 251,233 ha over the 618,836 ha recorded in 1987 (Fig. 4). Most of this increase occurred in Atikokan (82,183 ha), Thunder Bay (117,092 ha) and Nipigon (41,115 ha) districts. Relatively small increases were recorded in Terrace Bay (9,075 ha) and Geraldton (1,138 ha) districts. Results of tree mortality counts at specific plots, which have been monitored for a number of years, are presented in Table 3.

Table 3. North Central Region: Summary of spruce budworm-associated tree mortality based on ground checks for the past three years.

Location	Host	Tree Mortality (%)		
		1986	1987	1988
Atikokan District				
Flanders Rd and Hwy 11 - Stand 106	bF	37	70	90
Williamson Lake - Stand 251	bF	21	44	86
Seine River - 0.7 km S - Stand 331	bF	-	10	58
Geraldton District				
2.2 km east of Nibs Lake	bF	22	69	69
Nipigon District				
Muskrat River - Stand 333	bF	6	13	21
Shillabeer Creek - Stand 212	bF	12	18	24
Black Sturgeon Lake - Stand 132	bF	-	-	11
Adamson Twp - Stand 276	bF	-	-	9
Terrace Bay				
Barbara Lake - Stand 491	bF	46	72	88
Grain Twp - Stand 100	bF	-	-	50
Thunder Bay District				
Aldina Twp - Stand 19	bF	43	76	92
Burchell Lake - Stand 125	bF	51	69	75
Cheeseman Lake - Stand 274	bF	9	13	32
Conacher Twp - Stand 459	bF	8	23	53
Hagey Twp	bF	29	60	67
Sump Lake - Stand 92	bF	4	8	20

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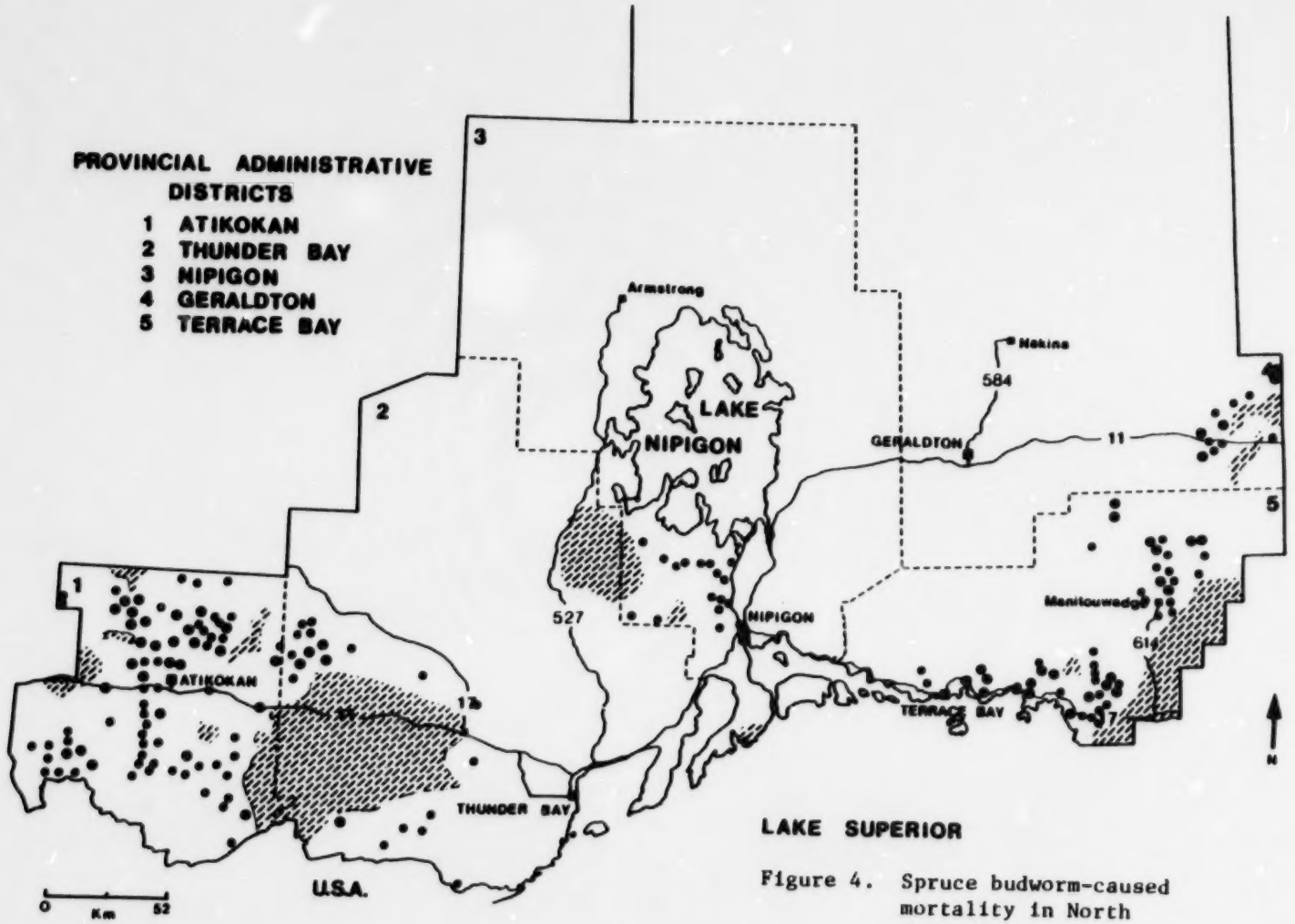

Figure 4. Spruce budworm-caused mortality in North Central Ontario

Areas within which balsam fir whole-tree and top mortality occur ▨ or ••

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Jack Pine Budworm, **Choristoneura pinus pinus** Free.

This pest of jack pine (**Pinus banksiana** Lamb.) caused moderate-to-severe defoliation over an area of approximately 600 ha in the Rush Creek area just east of English River in Thunder Bay District. This was the only area in the region that experienced significant damage in 1988. Although foliar damage in the infested area was not severe, the fact that it occurred at all is an indication that jack pine budworm populations may rebound. It had been anticipated that the infestation in northwestern Ontario was near an end, as jack pine budworm outbreaks are usually only 3-4 years in duration; however, 1988 was the fifth year of infestation in northwestern Ontario.

The results of egg-mass sampling were positive in the three areas sampled in and near the Rush Creek infestation, an indication that there is a strong probability of continued defoliation in that area in 1989. Other stands sampled in both Thunder Bay and Atikokan districts yielded negative results (Table 4).

Table 4. North Central Region - Jack Pine Budworm: Summary of defoliation estimates and egg-mass counts in 1988 and infestation forecasts for 1989 on jack pine.

Location	Estimated defoliation 1988 (%)	Total no. of egg masses on six 61-cm branch tips	Infestation forecasts for 1989[a]
Atikokan District			
Darby Creek - Stand 158	0	0	N
Rutter Lake - Stand 251	0	0	N
Thunder Bay District			
Hwy 17 & Rush Creek Rd - Stand 80	17	1	L
Kashishibog River - Stand 321	0	0	N
Moberley Lake - Stand 117	0	0	N
Rush Creek Rd - Stand 191	7	2	L
Rush Creek Rd - Stand 283	65	13	H

[a] N = nil, L = light, M = moderate, H = heavy

Greenstriped Maplevorm, **Dryocampa rubicunda** (F.)

This insect has been a periodic pest of red maple (**Acer rubrum** L.) in Atikokan District. It has not, however, been recorded in the

North Central Region since 1978, when light feeding was reported in the Flanders area. In 1988 there was a dramatic increase in population levels of the species. Extremely high numbers of young larvae were observed in the Lac la Croix area in late June and, subsequently, heavy defoliation resulted both there and in the nearby area of Eva Lake. North of the town of Atikokan, moderate-to-severe defoliation was evident near Finlayson Lake (85%) and in the Turtle Lake area (25%).

Mature larvae of the greenstriped maplevorm are about 40 mm long. Their feeding period extends from June to September but larvae are most common in late July and early August. Infestations of the maplevorm are generally brief, being regulated by natural control factors, but persistent epidemics have occasionally caused mortality of red maple in certain areas.

Birch Leafminer, **Fenusa pusilla** (Lep.)

The birch leafminer is an introduced pest, imported to the northeastern United States around 1923. It has since spread throughout most of eastern North America. Conspicuous browning of foliage caused by larval feeding has been common on open-growing and ornamental white birch (**Betula papyrifera** Marsh.) in the North Central Region for some time. Recently, damage has become more evident in natural forest stands in many areas. Typically, in areas within which damage is obvious, a large percentage of host trees is affected, usually over 70%, and the rate of foliar damage is generally very high (80-100%).

Damage in natural forest stands totaled 470 ha in Thunder Bay District. This occurred in numerous pockets but the bulk of the damage, approximately 300 ha, was found in the Kaministiquia River valley from Stanley north to the Sunshine area in the townships of O'Connor, Paipoonge, Conmee, Oliver, Forbes and Ware, and on the Dawson Road lots. Other areas of damage were recorded further west in Upsala and Conacher townships and in the east in McIntyre, MacGregor and McTavish townships. A total area of about 30 ha of white birch was damaged in Nipigon Township, Nipigon District. Damage to forested areas in Terrace Bay District was most evident in Brothers, Bomby and Lecours townships (12 ha) and at the south end of the Goldfield and Catlonite roads (5 ha). In Geraldton District, damaged areas totaling 5 ha were noted along the Industrial Road and Highway 625.

Urban areas throughout the region were affected by this pest. Specific surveys revealed that 60% of the trees were affected, and foliar damage amounted to 40% in the towns of Geraldton and Marathon. Somewhat heavier damage occurred in the towns of Longlac and Manitouwadge, where 85% of the trees were affected and there was 80% defoliation.

Forest Tent Caterpillar, **Malacosoma disstria** Hbn.

Populations of the forest tent caterpillar increased dramatically in 1988, as did the area within which defoliation of its main host, trembling aspen (**Populus tremuloides** Michx.), occurred. This was not unexpected as forecasts resulting from egg-band surveys in 1987 indicated such an expansion. The intensity of the outbreak also increased between 1987 and 1988, with the average defoliation level ranging from 60 to 85%.

The largest area of defoliation was in Atikokan District, where all previously infested areas expanded. Numerous new outbreaks were recorded from Eva Lake west to the Fort Frances District boundary as well as in the southwestern portion of the district in the Lac la Croix-Thompson-Namakan lakes area (Fig. 5). The total area of moderate-to-severe defoliation in the district was 28,160 ha.

In Thunder Bay District, the outbreak in the Kashabowie area increased from 70 ha to 4,100 ha; a new, relatively small area of 130 ha of infestation was delineated in Conmee Township; and the area of damage (200 ha) in Crooks Township remained approximately the same size as it was in 1987. Two areas, totaling 360 ha of infestation, were mapped near Red Rock in Nipigon District. In Terrace Bay District, the area of medium-to-heavy infestation near the Wawa District boundary almost doubled to 690 ha. Here, there were several pockets of infestation near the junction of hwys 614 and 17 in and just north of the townships of Bomby and Brothers.

Several locations were sampled for eggs so that population levels for 1989 could be forecasted (Table 5). Results indicate that the infestation will continue, with some expansion, in 1989.

Red Pine Sawfly, **Neodiprion nanulus nanulus** Schedl. and
Jack Pine Sawfly, **N. pratti banksianae** Roh.

The incidence of red pine sawfly increased for the second consecutive year. Although damage was generally light (5-10% foliar damage), colonies of the sawfly were evident on roadside and fringe jack pine trees in many areas from Thunder Bay west along Hwy 17 to English River and along Hwy 11 to the Atikokan area. Typical damage occurred in Fallis Township, Thunder Bay District, where 50% of 6-m trees were affected and defoliation averaged 8%, and at French Lake, Atikokan District, where 40% of 5-m trees were affected and there was 5% foliar damage. Low numbers of the insect were also recorded in McQuesten Township, Geraldton District.

The jack pine sawfly was also reported from a number of areas, though usually in smaller numbers than the red pine sawfly. Single jack pine trees or small groups of trees were affected at several locations in Ashmore Township, Geraldton District, and in the Shebandowan area, Thunder Bay District. Foliar damage at these locations averaged 5%.

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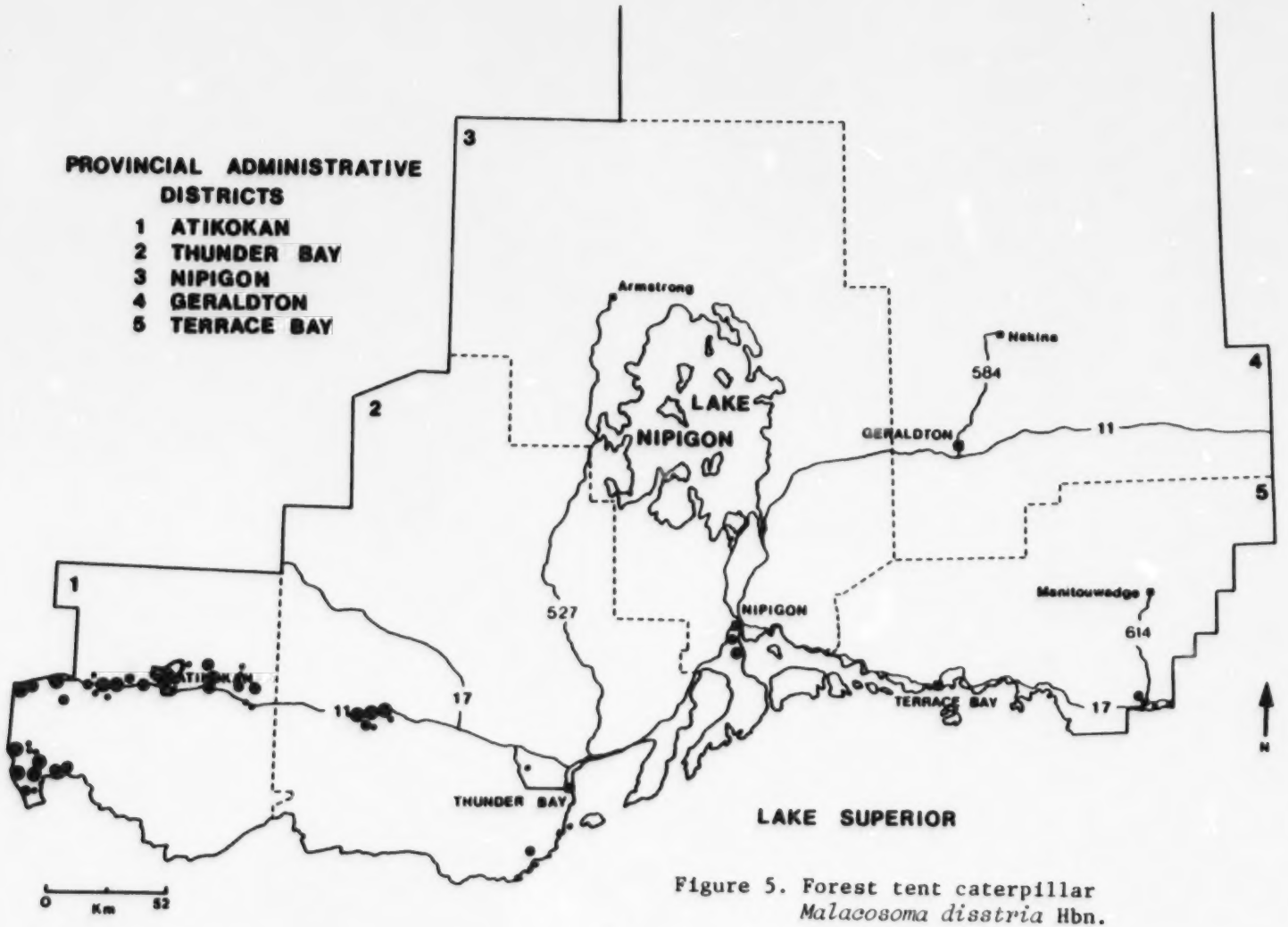

Figure 5. Forest tent caterpillar *Malacosoma disstria* Hbn.

Areas within which moderate-to-severe defoliation occurred in 1988

◈ or ●●●.

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Table 5. A summary of forest tent caterpillar egg-band counts on trembling aspen in the North Central Region in 1988, with infestation forecasts for 1989.

Location (Twp)	Avg DBH of trees (cm)	Avg no. of egg bands per tree	Infestation forecast for 1988
Terrace Bay District			
Brothers Twp, Hwy 17	9	0.7	light
Brothers Twp, Hwy 614	10	7.0	severe
Hwy 614, Barbara Lake	10	0	nil
Strey Twp	10	0	nil
Nipigon District			
Ledger Twp	11	0	nil
Red Rock	12	10.5	severe
Thunder Bay District			
McTavish Twp	13	2.0	moderate
Sibley Twp	10	0.3	light
Crooks Twp	14	4.3	moderate
Conmee Twp	10	11.0	severe
Kashabowie	13	50.0	severe
Hwy 802	17	0.7	light
Haines Twp	13	2.3	moderate
Hagey Twp	11	1.3	light
Fallis Twp	13	1.7	light
Pyramid Twp	12	2.6	moderate
Atikokan District			
French Lake	12	3.3	moderate
Hwy 11 - Nym Lake	10	9.5	severe
Schwenger Twp	15	119.0	severe
Hwy 807 - Eye Lake	11	6.3	severe
Hwy 807 - Little Turtle R.	14	5.3	moderate
Hwy 11 - Lerome Lake	9	45.0	severe
Hwy 11 - Twinling Lake	10	15.0	severe
Flanders	12	13.5	severe
Mahon Lake	17	3.0	moderate
Hutchison Twp	15	58.0	severe

Yellowheaded Spruce Sawfly, **Pikonema alaskensis** (Roh.)

A distinction of the yellowheaded spruce sawfly is that it tends to infest the same areas, and often the same trees, year after year. Damage recurred at a number of locations in 1988, two in Geraldton District. One was a 0.5-ha portion of a 20-ha plantation of 2-m-tall black spruce, which was heavily damaged again. In 1988, 30% of the trees had >80% defoliation, while the remaining trees had foliar damage ranging from 10 to 80%. The other area was at a gas pipeline crossing on Hwy 11, where 25 white spruce had an average of 60% defoliation. At both of these locations repeated attack by the sawfly has caused light tree mortality. Once again the sawfly was recorded at the O'Connor Seed Orchard, Thunder Bay District, where early surveys revealed that 46% of the 1.9-m-tall black spruce were infested, but chemical control with Malathion minimized foliage loss. Other areas in which damage recurred in Thunder Bay District were Kakabeka Falls Provincial Park (20% defoliation of 25% of the spruce ornamentals) and the gas pipeline-highway crossing near English River (100% of trees affected, with an average of 25% foliar damage). In Atikokan District, 20% defoliation was recorded on a small group of ornamental white spruce at French Lake.

Newly affected areas were detected at Cache Bay on Saganaga Lake in Atikokan District, where a small group of 25 shoreline black spruce averaged 60% foliar damage; near Stanley and in the city of Thunder Bay, Thunder Bay District, where damage ranged from 30 to 60% on ornamental spruce; and in Roberta Township, Terrace Bay District, where 90% of the white spruce in a 6-ha area sustained 85% defoliation.

White Pine Weevil, **Pissodes strobi** (Peck)

For the second consecutive year, leader damage resulting from white pine weevil attack has declined. The highest incidence (13%) occurred near Caldwell Lake, Atikokan District; however, this was on white pine (**Pinus strobus** L.), which is a more susceptible host than either jack pine or spruce. In the 19 other locations in which the pest was found, leader mortality ranged upwards to 7% and averaged 2.3%, in comparison with 4.5% in 1987 (Table 6). Negative results were recorded in another 11 areas.

Early Aspen Leafcurler, **Pseudexentera oregonana** (Wlsm.)

Populations of this common leafroller increased to moderate levels in several areas of the region. Defoliation was confined to trembling aspen and was generally in the 20-30% range, although scattered individual trees suffered heavier damage, some as much as 70% defoliation. A total area of approximately 2,600 ha was affected with such damage. Of this total, 1,100 ha were located in McCaul and Weaver townships and near Horseshoe Lake in Atikokan District; 200 ha were infested in Thunder Bay District near the junction of hwys 527 and 811; and 1,300 ha of aspen were defoliated near Albert Lake in Adamson Township, and near

Gull Bay in Nipigon District. Small populations also occurred at several other locations in Geraldton and Nipigon districts.

Table 6. A summary of damage caused by the white pine weevil in five districts in the North Central Region in 1988 (counts based on the examination of a minimum of 150 trees at each location).

Location	Area affected (ha)	Estimated no. of trees/ha	Host	Avg ht of trees (m)	Leaders attacked (%)
Atikokan District					
Caldwell Lake	2	3,000	wP	1.4	13.0
Pekagoning Lake	20	4,000	jP	0.7	1.0
Sapawe-Upsala Road	10	2,000	jP	2.1	1.0
Nipigon District					
Lyon Twp	10	4,000	jP	2.3	0.7
Ledger Twp	30	2,000	bS	3.8	4.0
Limestone Lake	50	2,500	bS	4.9	6.0
Sturgeon River	20	2,500	jP	3.0	0.7
Geraldton District					
Exton Twp	40	2,500	jP	1.4	0.7
Poilu Lake	50	1,111	wS	2.6	0.7
Terrace Bay District					
Industrial Road	8	2,500	wS	1.8	5.3
Janet Lake Road	30	2,500	wS	2.3	2.7
Thunder Bay District					
Hardwick Twp	20	1,800	jP	5.6	2.0
East Bay-Dog Lake	61	4,500	jP	3.1	2.7
Stucco Lake	20	3,650	jP	0.7	0.7
Mack Road	14	4,300	jP	3.0	0.3
Pearson Twp	0.2	1,100	wS	1.6	0.7
O'Connor Twp	5	1,100	bS	2.0	0.7
English River	50	2,500	jP	0.9	7.0
Parry Twp	20	2,500	jP	1.8	2.0
Camp 517 Road	20	2,500	jP	1.2	4.0

Minor Insects

Large Aspen Tortrix, **Choristoneura conflictana** (Wlk.)

In 1987, a total area of 121,830 ha of trembling aspen had moderate-to-severe defoliation. This infestation also had a large population of Bruce spanworm (**Operophtera bruceata** Hlst.) in the southern portion of Thunder Bay District. The large aspen tortrix population completely collapsed in this area in 1988, and the only area of appreciable defoliation occurred in Priske and Strey townships, Terrace Bay District, where 620 ha of trembling aspen sustained moderate-to-severe damage. This was a recurrence of an infestation that had developed in 1986 but was absent in 1987. In addition, 360 ha of this area supported a population of linden looper (**Erannis tiliaria** Harr.).

Linden Looper, **Erannis tiliaria** (Harr.)

Large infestations of this defoliator occasionally occur. The last infestation in or near the North Central Region was in 1974-1975 in a band that stretched from Wawa to Montreal River in the adjacent Northeastern Region. In 1988, moderate-to-severe defoliation totaled 8,835 ha in the southern portion of Terrace Bay District along Hwy 17 in Priske, Strey, Syine, Tuuri, Walsh, Coldwell, Grain and Pic townships (Fig. 6). In addition, there was 360 ha of mixed feeding by linden looper and large aspen tortrix just west of Terrace Bay. The most severe damage (50-80% defoliation) occurred on mature white birch stands on high, rocky sites.

Eastern Pine Shoot Borer, **Eucosma gloriola** Heinr.

Population levels of this insect, which have been depressed for several years, increased substantially in 1988. The shoot borer attacks the new growth of jack pine regeneration, causing the most damage to sapling-sized trees in the 1- to 5-m height category. The insect apparently has a penchant for the leader of jack pine, as this is quite often the only part of the tree affected. The larvae feed within the new shoots and effectively girdle the shoot from the inside, often causing it to break off at the girdled point.

Damaged areas were confined to Atikokan District and the southern and western parts of Thunder Bay District. Much of this same area was infested with the shoot borer in the late 1970s; populations peaked in 1979 when the average leader damage was 11%. In 1988, the average leader damage from the 11 positive locations surveyed in this area was 5.7% (Table 7).

The insect was not recorded in Geraldton District. It caused only 0.7% leader damage at one location in a plantation along the Everest Lake Road, Terrace Bay District, and at one point in Lyon Township, Nipigon District.

TERRACE BAY DISTRICT

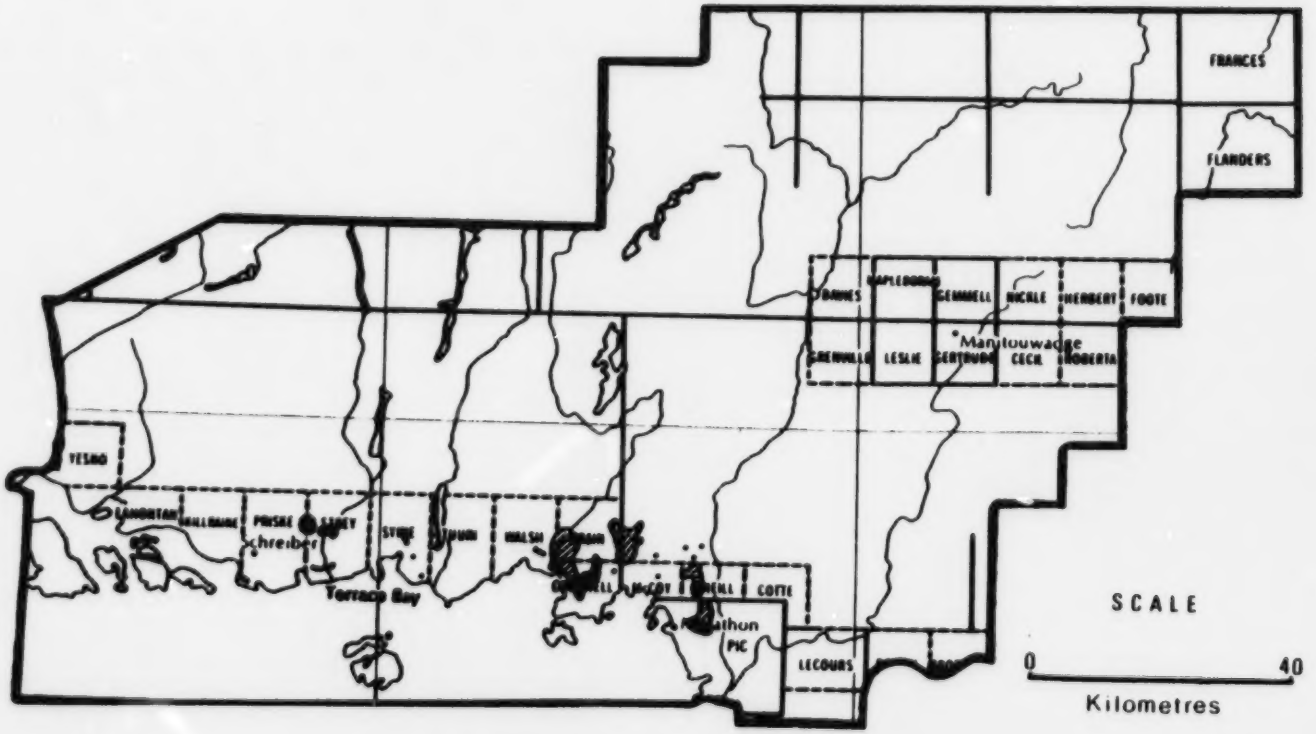


Figure 6. Linden looper
Erranis tiliaria (Harr.)

Areas within which moderate-to-severe defoliation occurred in 1988 ▨ or ▪

Forest Insect and Disease Survey
Great Lakes Forestry Centre

Table 7. Summary of damage on jack pine caused by the eastern pine shoot borer in three districts in the North Central Region in 1988 (counts based on the examination of a minimum of 150 trees at each location).

Location	Area affected (ha)	Estimated no. of trees/ha	Avg ht of trees (m)	Leaders attacked (%)
Atikokan District				
Pekagoning Lake	20	4,000	0.7	1.0
Sawmill Lake	40	4,400	7.4	2.0
Sapave-Upsala Road	10	2,000	2.1	12.0
Stanton Lake Road	10	2,500	3.5	6.0
Thunder Bay District				
Upper Shebandovan Lake	10	2,500	2.5	8.0
Hardwick Twp	20	1,800	5.6	5.3
East Bay-Dog Lake	61	4,500	3.1	4.3
Mack Road	14	4,300	3.0	11.0
English River	50	2,500	0.9	5.0
Parry Twp	20	2,500	1.8	4.5
Camp 517 Road	20	2,500	1.2	3.3

American Aspen Beetle, **Gonioctena americana** (Schaeff.)

Populations of this young aspen defoliator were on the rise in 1988, although defoliation levels generally remained lov. The exception to this was in Hardwick Township, Thunder Bay District, where 40% defoliation occurred in a 1-ha area of 1- to 5-m regeneration aspen. Trace damage levels were observed at various other locations in Atikokan, Thunder Bay, Geraldton and Terrace Bay districts.

Bruce Spanvorm, **Operophtera bruceata** (Hlst.)

For the second consecutive year, this looper caused widespread damage to trembling aspen in the southern parts of Atikokan and Thunder Bay districts. Moderate-to-severe defoliation occurred over a total area of 680,455 ha, up from the 617,600 ha that were infested in 1987. The largest area of infestation, 550,860 ha, extended from the western shore of Lake Superior to the eastern half of Quetico Park in Atikokan District. The other sizable area of defoliation, 94,480 ha, was located east of the city of Thunder Bay and extended from Dorion Township to Gorham Township and south to Sibley Provincial Park in Thunder Bay District. There were several smaller areas of infestation on the periphery of the larger areas of outbreak in both affected districts (Fig. 7).

NORTH CENTRAL REGION

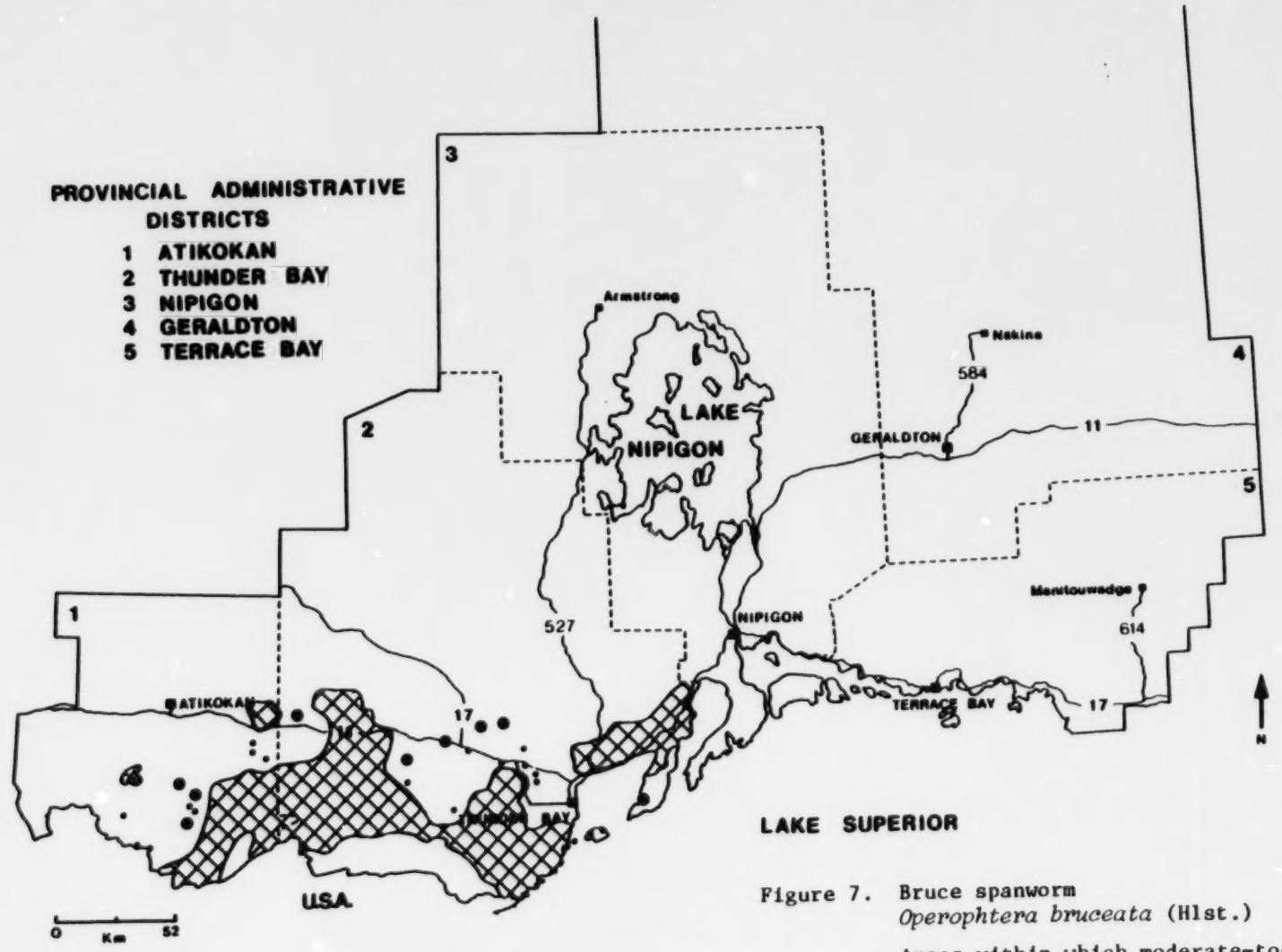


Figure 7. Bruce spanworm
Operophtera bruceata (Hlst.)

Areas within which moderate-to-severe defoliation occurred in 1988
⊠ or ●.

Forest Insect and Disease Survey
Great Lakes Forestry Centre

Aspen Leafblotch Miner, **Phyllonorycter ontario** (Free.)

Populations of the aspen leafblotch miner, a foliage pest of trembling aspen regeneration, were on the increase after being somewhat depressed in 1987. A high incidence (50-100%) of the insect and 60-90% foliar damage were found along Hwy 580, in Lake Nipigon Provincial Park and in Walters and Rickaby townships, Nipigon District; along the Amvri Lake Road in Terrace Bay District; and along Hwy 625 in Geraldton District. Similar damage was found in several locations in Atikokan District, most notably in the Flanders, Finlayson Lake and French Lake areas, where defoliation averaged 80%. Slightly lighter foliar damage (50%) occurred in Hardwick Township, near Wolfpup Lake and in the East Bay (Dog Lake) area, Thunder Bay District.

Table 8. Other forest insects.

Insect	Host(s)	Remarks
Adelges abietis (L.) Eastern spruce gall adelgid	bS	an average of 50% defoliation reported on understory trees near Caldwell Lake, Atikokan District
Agrotis ipsilon (Hufn.) Black cutworm	weeds grass	larvae reported in several compartments at the Thunder Bay Forest Nursery, but no seedling damage; damage to roots of grass on the greens at Kenogamasis Golf Course, Geraldton District
Anacampsis innocuella (Zell.) Darkheaded aspen leafroller	tA	trace populations found in Ledger Twp, Nipigon District and Strey Twp, Terrace Bay District
Anacampsis niveopulvella (Chamb.) Paleheaded aspen leafroller	tA	small populations with no discernible defoliation in Patience Twp, Nipigon District and Rupert Twp, Geraldton District
Aphrophora cribrata (Wlk.) Pine spittlebug	jP	Trace population levels were found in Parent Twp and along Hwy 625 in Geraldton District.

(cont'd)

Table 8. Other forest insects (cont'd).

Insect	Host(s)	Remarks
Archips argyrospila (Wlk.) Fruittree leafroller	W	observed on roadside trees along Sturgeon River Road, Nipigon District, with trace foliar damage levels
Caloptilia fraxinella (Ely) Privet leafminer	bAsh	small numbers of larvae recorded in a small stand of black ash (**Fraxinus nigra** Marsh.) in Kilkenny Twp, Nipigon District
Caloptilia negundella (Cham.) Boxelder leafroller	mM	Ornamentals in the Vickers Park area of Thunder Bay sustained an average of 22% foliar damage, with 100% of the trees affected.
Dioryctria reniculelloides Mut. & Mun. Spruce coneworm	wS	feeding in concert with spruce budworm at several locations, making up 15% of total larval numbers in the following areas: along the Sapawe-Upsala Road, Atikokan District; in Adamson Twp, Nipigon District; and near MacKenzie, Thunder Bay District
Epinotia solandriana (L.) Birch aspen leafroller	tA	feeding with other leaf-rollers and tiers in Ledger Twp, Nipigon District
Eriocampa ovata (L.) Woolly alder sawfly	Al	Large populations caused up to 100% defoliation in some instances in Ware, Oliver, McIntyre and Paipoonge twps, Thunder Bay District.
Hyphantrea cunea (Drury) Fall webworm	decid-uous	Scattered colonies caused 50% foliar damage to host trees in Oliver and Pearson twps, Thunder Bay District.

(cont'd)

Table 8. Other forest insects (cont'd).

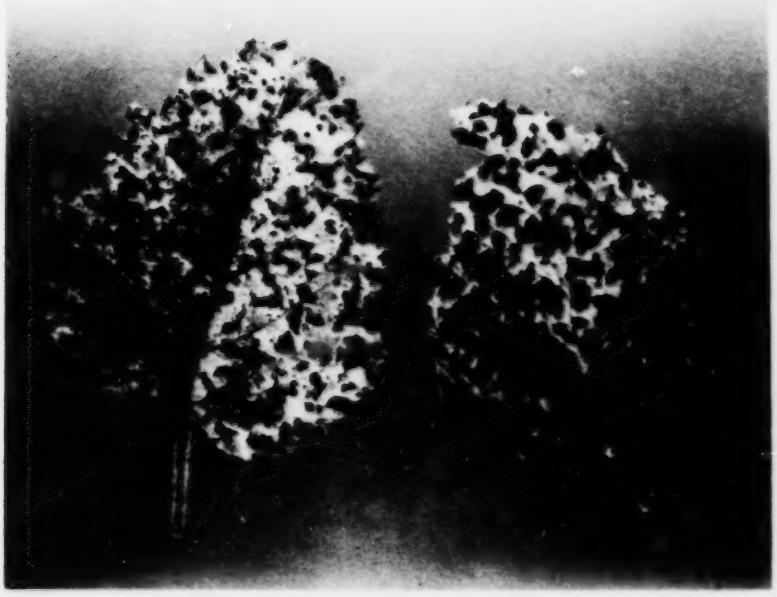
Insect	Host(s)	Remarks
Malacosoma californicum pluviale (Dyar) Northern tent caterpillar	decid-uous	Defoliation of 50% was common on various hardwoods (single trees) at locations in the Stucco Lake area, Thunder Bay District.
Mindarus abietinus Koch Balsam twig aphid	bF	Trace levels of larvae were observed on Minnie Island in Lake Superior, Terrace Bay District.
Monochamus sp. Sawyer beetle	jP	Five hectares of standing timber were damaged adjacent to cutovers in the Rush Creek area, Thunder Bay District.
Neodiprion maurus Roh. Pine savfly	jP	60% of 2-m-tall natural regeneration affected, and an average defoliation of 25% (in conjunction with other sawflies) in Matavin Seed Orchard, Thunder Bay District
Neodiprion swainei Midd. Swaine jack pine savfly	jP	20% foliar damage on 50% of the trees near Finlayson Lake, Atikokan District
Neodiprion virginiana complex Redheaded jack pine savfly	jP	Increased incidence was noted in 1988, but generally there were only single colonies on individual trees, with <5% foliar damage. The exception was in Fowler Twp, Thunder Bay District, where 10% of the 7-m-tall trees had 5% foliar damage.
Neurotoma inconspicua (Nort.) Plum webspinning savfly	pCh	A single tree sustained 80% foliar damage at English River, Thunder Bay District.

(cont'd)

Table 8. Other forest insects (concl.).

Insect	Host(s)	Remarks
Nites betulella (Bsk.) Blackdotted birch leaftier	wB	trace damage levels found at two locations--Klotz Lake Provincial Park, Geraldton District, and Parks Lake, Nipigon District
Orthosia hibisci (Gn.) Speckled green fruitworm	wB, tA	increased incidence in Nipigon and Terrace Bay districts, with negligible defoliation
Petrova albicapitana (Bsk.) Northern pitch twig moth	jP	found at several locations in Geraldton and Terrace Bay districts, usually only one per site
Pristiphora erichsonii (Htg.) Larch sawfly	L	Populations have declined to very low levels. Only two locations--the OMNR Air Base in Geraldton District and Middle Falls Provincial Park in Thunder Bay District--had minor foliar damage.
Pristiphora geniculata (Htg.) Mountain-ash sawfly	moAsh	Overall incidence in the region was about the same as in 1987. Damage levels varied from 5% foliar loss up to 90% defoliation on a single bush on the OMNR Air Base, Geraldton District.
Tipula sp. Crane fly	Soil	larval collections made at the Thunder Bay Forest Nursery; no evident seedling damage
Zeiraphera canadensis Mut. & Free. Spruce bud moth	wS	moderate population with trace defoliation on one white spruce in Neys Provincial Park, Terrace Bay District

Closeup of greenstriped mapleworm (*Dryocampa rubicunda* [F.]) feeding on red maple (*Acer rubrum* L.)



Leaf discoloration and fruiting bodies of leaf blight on birch (*Septoria betulae* Pass.)

TREE DISEASES

Major Diseases

Armillaria Root Rot, **Armillaria mellea** (Vahl:Fr.) Kummer

Armillaria root rot was again commonly found in plantations throughout the region. It was recorded as causing 1-2% mortality in approximately half of the young jack pine plantations examined in 1988. Spruce seed orchards from across the region were surveyed for evidence of this disease organism. Results of this survey were negative except at the Matawin Seed Orchard, Thunder Bay District. Here, 0.7% of the 6.0-m-tall black spruce seed trees displayed evidence of recent Armillaria root rot attack. Also, several older dead trees, both black spruce and white spruce, manifested signs of the disease. A mortality rate in the 1-2% range is not unusual; occasionally, however, this fungus becomes a virulent primary pathogen and can cause heavier damage. Two examples of this were reported in 1988. A small 2-ha plantation of 1-m-tall jack pine along Hwy 584 near Camp 48 Road, Geraldton District sustained 25% mortality and 50% of 30 1.5-m-tall ornamental jack pine and red pine (**Pinus resinosa** Ait.) at Neys Provincial Park, Terrace Bay District suffered attack by the root rot.

Scleroderris Canker, **Ascocalyx abietina** (Lagerb.) Schläpfer-Bernhard

Once again in 1988, observations were made to try to detect the presence of both the North American race and the more virulent European race of this canker. In 1987, all results were negative but in 1988, two samples were positively identified as belonging to the North American race. Just east of the Namevaminikan River in Nipigon District, 11 km south of Hwy 11, a 300-tree survey in a 20-ha jack pine plantation revealed that 3% of the 3-m-tall trees were infected with Scleroderris canker. In Geraldton District, near Lukinto Lake, a single jack pine was found to be infected.

Spruce Needle Rusts, **Chrysomyxa ledicola** (Peck) Lagerh. and
Chrysomyxa ledi var. **cassandrae**
(Peck & G.P. Clinton)

Again in 1988, this foliar disease was confined almost exclusively to the eastern half of the region, with only trace levels of infection detected in the western portion. Although it was still videspread in Geraldton, Terrace Bay and Nipigon districts, a slightly dovnvard trend in the level of infection vas noted. In general, vhen samples vere obtained, 100% of the trees vere affected vith 1-3% foliar damage. The notable exception to this vas along Janet Lake Road in Terrace Bay District, vhere a 20-ha vhite spruce plantation had 7.6% foliar damage.

Ink Spot of Aspen, **Ciborinia whetzelii** (Seaver) Seaver

Surveys in 1988 indicated a definite increase in the incidence of this disease within the region. Damage levels varied from district to district, with the eastern portion of the region generally suffering higher levels. In Thunder Bay District 10 ha of aspen regeneration in Paipoonge Township had 20% foliar damage, while similar defoliation levels were encountered on 60 ha of aspen in Forbes Township. Near Red Rock in Nipigon District, 1 ha of 7-m-tall trees had 30% defoliation. In Geraldton District, a 0.5-ha stand in McQuesten Township had 85% infection levels and a 0.5-ha stand in Oakes Township had 60% damage levels. A 2-ha stand along Industrial Road, Terrace Bay District had 70% foliar damage, while along Hwy 614 in Terrace Bay District, infection levels of 90% were observed.

Pine Needle Rust, **Coleosporium asterum** (Dietel) Sydow

This disease was fairly widespread in the region but damage levels remained generally low, with a few exceptions. Near the Granite River in Thunder Bay District, 0.6-m-tall jack pine were 80% affected, and foliar damage averaged 20%; near Stucco Lake in Thunder Bay District, 0.7-m-tall jack pine trees were 62% affected, and had 6% foliar damage. In an area off the Hematite Road, Atikokan District, 2% of 0.7-m-tall red pine sustained 80% damage. A small jack pine plantation in the Flynne Creek area, Geraldton District had 11% foliar damage.

Western Gall Rust, **Endocronartium harknessii** (J.P. Moore) Y. Hirats.

This was the most frequently encountered and widespread disease in 1988. The heaviest damage inflicted by branch galls occurred in Eva Township, Nipigon District, where 85% of the trees were affected in a 20-ha, 16-m-tall jack pine plantation. The heaviest damage caused by stem galls was in a 14-ha, 3-m-tall jack pine plantation on Mack Road, Thunder Bay District, where 19% of the trees were severely affected.

Minor Diseases

Septoria Leaf Spot, **Mycosphaerella populicola** G.E. Thompson

In 1987 this leaf fungus was confined mostly to the western part of the region, but in 1988 was prevalent throughout the region, causing discoloration and early leaf fall in balsam poplar (**Populus balsamifera** L.) stands. Defoliation was severe in most areas, with many stands having 100% foliar damage.

Leaf Blight, Septoria betulae Pass

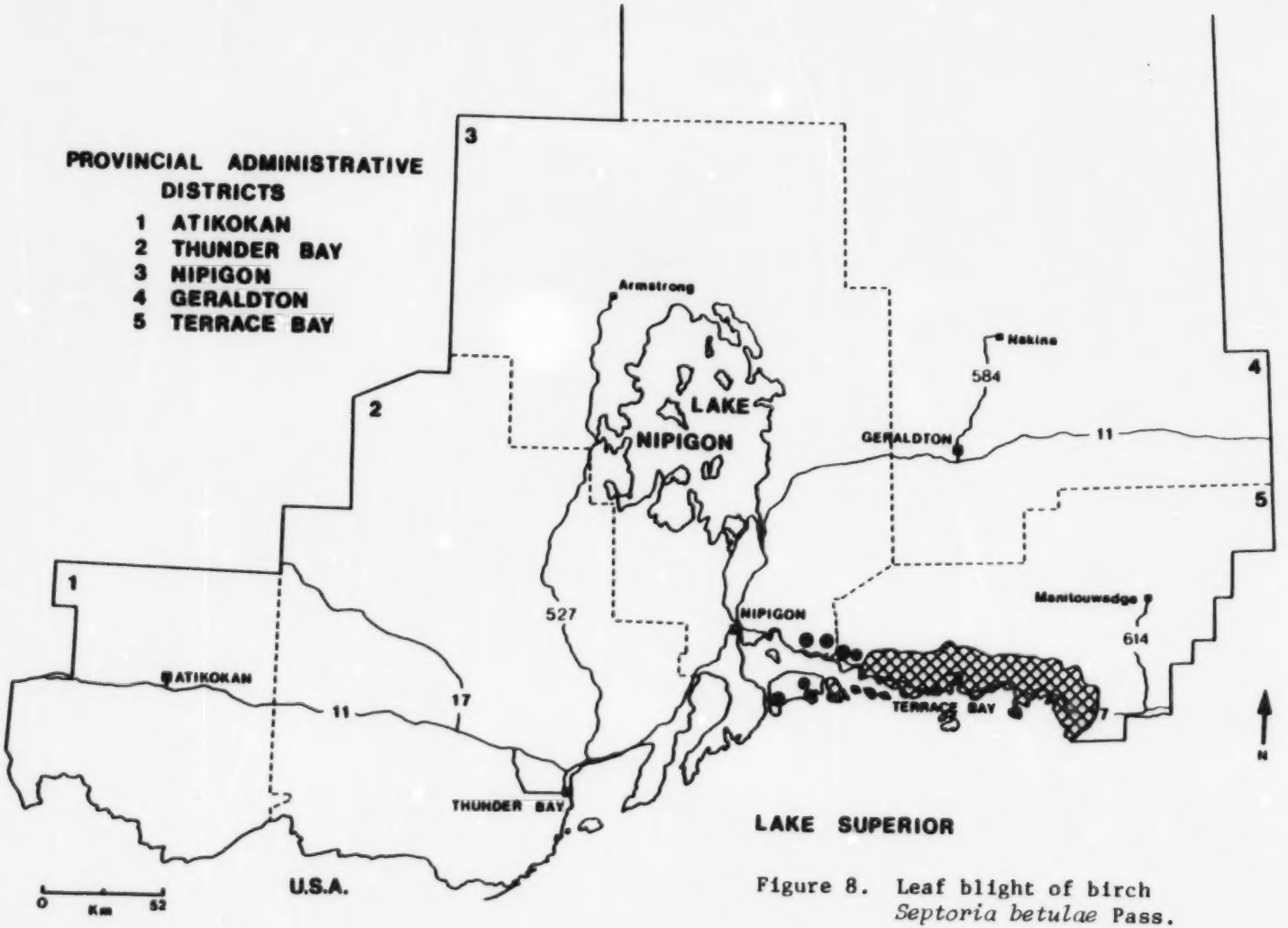
This leaf blight of birch periodically infects large areas of forest, causing severe browning of the foliage and possible early leaf fall. In 1988 a total of 218,019 ha of white birch was affected in the southern part of Terrace Bay and Nipigon districts, with the main body of 199,750 ha located in Terrace Bay District. Many of the offshore islands in Lake Superior were also infested (Fig. 8). Much of the birch affected was on rocky, shallow-soil sites and, with dry conditions prevailing through much of the summer, was likely under stress.

Table 9. Other forest diseases.

Disease	Host(s)	Remarks
Apiosporina collinsii (Schwein.) Höhnel Apiosporina witches' broom	Service-berry	found at two locations in Nipigon District--at Postagomi Lake where three trees had 50% foliar damage, and in Patience Twp, where one tree was affected
Asteroma microspermum (Peck) B. Sutton Leaf spot	wB	80% of foliage affected on roadside trees along Goldfield Road, Geraldton District
Ceratocystis ulmi (Buism.) C. Moreau Dutch elm disease	wE	Current infections were evident on 7% of trees in the town of Atikokan, Atikokan District.
Chrysomyxa arctostaphyli Dietel Spruce broom rust	bS	collected from one tree in Pic Twp, Terrace Bay District
Cronartium coleosporioides Arthur Orange stalactiform blister rust	jP	Branch rust infections were reported at three locations; incidence ranged from 0.3% to 1.3%.
Cronartium comptoniae Arthur Sweet fern blister rust	jP	In regeneration areas on Mack Road and East Bay on Dog Lake in Thunder Bay District, 0.3% of the trees were affected.
Cronartium ribicola J.C. Fischer White pine blister rust	wP	Along Premier Lake Road, Atikokan District, 13% of 1.7-m-tall trees were affected, 9% severely, in an area of natural regeneration.

(cont'd)

NORTH CENTRAL REGION



Forest Insect and Disease Survey
Great Lakes Forestry Centre

Figure 8. Leaf blight of birch *Septoria betulae* Pass.

Areas within which moderate-to-severe leaf discoloration occurred in 1988 ▨ or ● ● ●

Table 9. Other forest diseases (concl.).

Disease	Host(s)	Remarks
Davisomycella ampla (J. Davis) Darker Tar spot needle cast	jP	This needle cast was found at two locations in Thunder Bay District--in Hardwick Twp, where 20% of 5.6-m-tall trees had an average of 5% foliar damage, and near Mack, where 3% of 3-m-tall trees had 10% defoliation; one tree in the high-value survey at Sturgeon River, Nipigon District, had 10% defoliation.
Glomerella miyabeana (Fukushi) v. Arx Black canker of willow	W	98-100% foliar damage recorded on eight of ten ornamentals at Chippeva Park in the city of Thunder Bay
Isthmiella crepidiformis (Darker) Darker Needle cast	bS	One tree had 50% of its foliage affected in Ledger Twp, Nipigon District.
Pucciniastrum epilobii Otth Fireweed rust	bF	5% foliar damage observed on regeneration trees on an island in Steel Lake, Terrace Bay District
Sphaeropsis sapinea (Fr.) Dyko & B. Sutton Tip blight	rP	Approximately 10% of 0.6-m-tall regeneration was affected near Caldwell Lake, Atikokan District.
Venturia macularis (Fr.) E. Müller & v. Arx Shoot blight	tA	100% of regeneration aspen affected, with 15% of the leaders damaged, in Wiggins Twp, Terrace Bay District

ABIOTIC DAMAGE

Blowdown

Violent windstorms in late spring and early summer caused massive blowdown in several areas of the region in 1988 (Fig. 9). The largest area was in the Harmon-Waterhouse-Uneven lakes area in the northern part of Thunder Bay District. This blowdown bordered on a larger area in Ignace District of the Northwestern Region. A total gross area of approximately 7,400 ha was affected in Thunder Bay District. A second area of damage was located in the Armistice Lake area, also in Thunder Bay District, and involved 600 ha of forested lands.

There were also two separate areas of blowdown in Geraldton District. The larger was in the Esnagami Lake area. Here, along the northern side of the lake and on the eastern side of nearby Maun Lake, about 2,500 ha of timber were flattened. The smaller area was in Colter Township, where 185 ha were affected. In both areas, black spruce and trembling aspen were the primary species affected.

There was a relatively small area of blowdown south of Pipe Lake in Atikokan District. Here, 25 ha of jack pine and black spruce adjacent to large clear-cut areas sustained wind damage.

SPECIAL SURVEYS

Jack Pine Plantation Survey

A continuing program of monitoring pest problems in plantations focused on jack pine regeneration in 1988. In all, 12 areas were examined in three height categories: <2 m, 2 m-6 m and >6 m. Two visits were made to each location because of differences in seasonal occurrences of various insects and diseases.

The most common problem was gall rust, which was present in 10 of 12 plantations. White pine weevil, eastern pine shoot borer and pine needle rust were each found at 5 of 12 locations. Quantitative data for these organisms, as well as for jack pine tip beetle, **Conophthorus banksianae** McP., Armillaria root rot and tar spot needle cast, are listed in Table 10. Scleroderris canker was found only at the Sturgeon River (Nipigon District) location, where it was affecting 3% of the trees. Jack pine budworm caused very light foliar damage (1%) on fever than 10% of the trees at both Kopka Lake, Nipigon District, and Mack Road, Thunder Bay District. A stem rust, **Cronartium** sp., was affecting single trees at Mack Road and East Bay, Dog Lake, Thunder Bay District. Neither the Swaine sawfly nor the jack pine sawfly was found; however, a single tree in Rupert Township, Geraldton District was infested with the redheaded jack pine sawfly, and another single tree at Sawmill Lake, Atikokan District was infested with the red pine sawfly.

NORTH CENTRAL REGION

Figure 9. Blowdown

Areas within which high winds caused blowdown in 1988 ■ or ••.

Forest Insect and Disease Survey
Great Lakes Forestry Centre

Table 10. A summary of insect and disease damage detected in a special survey of jack pine plantations in the North Central Region (percentages based on the examination of 150 trees at each location unless otherwise noted).

Location	Avg ht of trees (m)	Plantation area (ha)	Estimated trees/ha	White pine weevil	Eastern pine shoot borer		Jack pine tip beetle	
				Leaders attacked (%)	Trees affected (%)	Leaders attacked (%)	Trees affected (%)	Leaders attacked (%)
Geraldton District								
Rupert Twp	9.1	40	1,600	0	0	0	0	0
Hanover Lake	1.2	53	2,500	0	0	0	0	0.7
Lukinto Lake*	2.9	50	2,500	0	0	0	0	0
Terrace Bay District								
Everest Lake Road	0.8	96	2,500	0	0.7	0.7	0	0
Nipigon District								
Sturgeon River*	2.7	20	2,500	0.3	0	0	1.3	0
Eva Twp	16.2	50	2,500	0	0	0	0	0
Kopka Lake	1.0	47	4,000	0	0	0	0	0
Atikokan District								
Sawmill Lake	7.4	40	4,400	0	5.3	2	4.0	0.7
Thunder Bay District								
East Bay, Dog Lake*	3.3	61	4,500	2.7	8.7	4.3	3.7	0
Mack Road*	3.1	14	4,300	0.3	20.0	11.0	22.0	0.3
Stucco Lake	0.7	20	3,650	0.7	0	0	0	0
Hardwick Twp	5.6	20	1,800	2.0	7.3	5.3	0	0.7

(cont'd)

Table 10. A summary of insect and disease damage detected in a special survey of jack pine plantations in the North Central Region (percentages based on the examination of 150 trees at each location unless otherwise noted) (concl.).

Location	Armillaria root rot	Pine needle rust		Western gall rust		Tar spot needle cast	
	Trees attacked (%)	Trees attacked (%)	Defoliation (%)	Trees attacked (%)	Severely affected (%)	Trees attacked (%)	Defoliation (%)
Geraldton District							
Rupert Twp	0	0	0	7.0	1.0	0	0
Hanover Lake	0	0	0	0	0	0	0
Lukinto Lake*	0.7	0	0	14.0	6.0	0	0
Terrace Bay District							
Everest Lake Road	0	2.0	2	0	0	0	0
Nipigon District							
Sturgeon River*	1.7	0	0	4	1.0	0.7	10
Eva Twp	0	0	0	85	0	0	0
Kopka Lake	3.3	0	0	4	2.0	0	0
Atikokan District							
Savmill Lake	0	0	0	45.3	6.0	0	0
Thunder Bay District							
East Bay, Dog Lake*	1.3	24.0	1	18.3	1.7	0	0
Mack Road*	0.3	1.7	1	36.0	18.7	2.7	10
Stucco Lake	0	62.0	6	0.7	0.7	0	0
Hardwick	0.7	81.0	1	31.0	4.0	20.0	5

* 300 trees surveyed at each location

Jack Pine Cone and Seed Survey

In 1988, jack pine cones were collected by Forest Insect and Disease Survey (FIDS) staff to determine the incidence of damaging cone and seed pests and subsequent seed loss. The two sample areas were Paipoonge Township, Thunder Bay District and Colter Township, Geraldton District. In Colter Township, only 4% of the cones were damaged, with 53% seed loss within the damaged cones. Lepidoptera larvae and unknown pests were responsible for the damage. In Paipoonge Township, 30% of the cones were damaged, with 25% seed loss within these cones. Pests responsible for this seed loss, in order of importance, were: **Dioryctria** sp.; lepidoptera larvae; the northern pitch twig moth, **Petrova albicapitana** (Bsk.); the fir conevorm, **Dioryctria abietivorella** (Grt.); the eastern pine seedworm, **Cydia toreuta** (Grt.); and a midge, **Resseliella** sp.

Gypsy Moth, **Lymantria dispar** (L.)

Pheromone traps were again set out, two at each location, in each of the 10 provincial parks and in one township park. These are designed to attract male moths through the use of synthetic pheromones. Traps were put in place by mid-July and were collected in late August or early September. All results were negative.

Pinewood Nematode, **Bursaphelenchus xylophilus** Steiner & Buhrer (Nickle)

Surveys in 1988 were concentrated on sampling recently dead and dying balsam fir and black spruce to determine the presence of the pinewood nematode. Samples were taken at 13 locations in the region. Healthy trees on these sites were marked to try to determine if the nematode is an inciting factor in tree mortality. The nematode was identified at two of the locations sampled, one a balsam fir stand and the other a black spruce stand, both in Geraldton District.

Beetles of various species, which may be vectors of the pinewood nematode, were collected at several locations. Many of these collections are still undergoing laboratory analysis.

Acid Rain National Early Warning System (ARNEWS)

The three ARNEWS plots in the North Central Region are part of a national netvork of such plots designed to monitor symptoms of damage from air pollutants, particularly acid rain. In addition, trees on these plots are evaluated with respect to level, extent and intensity of any insects or diseases that occur naturally. In 1988, no damage that could be attributed to acid rain was detected at any of the three plots. At the Margo Lake plot in Geraldton District, lov levels of western gall rust recurred on all of the jack pine and very lov levels of spruce needle rust were reported on some of the black spruce. Increased damage from spruce budvorm vas evident at the Wiggins Township plot in Terrace

Bay District. Budvorm defoliation averaged 70% on white spruce and 20% on black spruce. There were also traces of birch leafminer damage on the white birch at this site. Spruce budvorm damage also increased at the plot in Fowler Township, Thunder Bay District. Here, balsam fir foliar damage averaged 22%, whereas black spruce defoliation was only 3%. Trace levels of birch leafminer damage also occurred here.

Thunder Bay Forest Nursery

Insects and diseases did not have a major detrimental effect on seedling growth at the Thunder Bay Forest Nursery in 1988. Nevertheless, there were several occurrences worthy of mention.

June beetle (**Phyllophaga** sp.) larvae were found damaging the roots of 2 + 1 white spruce in compartments 85 and 73. Damage varied within the compartments and losses were minimized by preventative control measures. A very small number of white spruce seedlings (fewer than 1%) were infested with the northern pine weevil, **Pissodes approximatus** Hopk., in compartment 81. Cylindrocladium root rot, **Cylindrocladium floridanum** Sob. & C.P. Seym., has been recorded in approximately half of the compartments; however, losses as a result of this root rot are not of major concern and are still within the acceptable range.

Very small populations of the black cutworm, **Agrotis ipsilon** (Hufn.), were found in compartments 33, 42, 43, 44, 37 and 511. Feeding was confined to weeds. The black army cutworm, **Actebia fennica** (Tausch.), which caused seedling damage in 1987, was not found in the larval stage this year. A program of monitoring the adults of this cutworm was repeated and the six pheromone traps deployed caught a total of 104 male moths. This is a decrease from the 241 moths caught in 1987. Larvae of crane flies, **Tipula** sp., were collected in compartment 42. No seedling damage was evident and only small numbers were recorded. The larvae of crane flies are known as leatherjackets and are potentially a damaging pest of young seedlings and transplants.

A single trial seedling was affected by the red pine sawfly in compartment 7 and there were very small populations of spruce budvorm in the new spruce breeding orchard. There was, however, a substantial increase in budvorm damage to spruce hedges and windbreaks on the Nursery property. Over all, foliar damage was moderate (20-50%) on most of the white spruce, whereas somewhat lighter damage was found on black spruce. Jack pine trees near the Nursery were affected in varying degrees by western gall rust. Small numbers of jack pine budvorm and the northern pitch twig moth, **Petrova albicapitana** (Bsk.), were also found on jack pine in the surrounding area.

Climatic Data

Weather plays an obvious role in the ecology of insect and disease organisms, and can facilitate or hinder the development of such populations. A good example of this is mortality of spruce budworm larvae as a result of late frost. For this reason, temperature and precipitation records with deviations from normal for two weather stations in the region are presented in Table 11.

Table 11. A summary of temperature and precipitation for 1988 at two locations in the North Central Region.

Location	Month	Mean temperature (°C) Actual	Normal	Deviation from normal (°C)	Total precipitation (mm) Actual	Normal	Deviation from normal (%)
Thunder Bay Airport	January	-15.9	-15.4	-0.5	21.2	40.9	-48
	February	-16.0	-13.0	-3.0	7.1	28.3	-75
	March	-4.8	-6.3	+1.5	53.9	45.0	+20
	April	3.8	2.5	+1.3	13.4	50.7	-74
	May	10.0	8.8	+1.2	59.7	73.3	-19
	June	16.0	14.0	+2.0	32.1	76.6	-58
	July	19.4	17.6	+1.8	56.1	75.4	-26
	August	17.6	16.4	+1.2	170.4	83.1	+105
	September	12.0	11.1	-0.9	83.8	89.1	-6
	October	3.1	5.7	-2.6	53.8	54.8	-2
	November	-1.5	-2.6	+1.1	89.1	52.9	+68
	December	-12.4	-11.1	-1.3	49.5	41.1	+20
Geraldton Airport	January	-20.3	-20.0	-0.3	26.8	38.2	-30
	February	-20.2	-17.9	-2.3	30.2	33.3	-9
	March	-10.3	-11.0	+0.7	65.2	38.2	+71
	April	0.7	-0.5	+1.2	32.8	43.3	-24
	May	10.0	7.7	+2.3	65.0	63.2	+3
	June	14.6	13.5	+1.1	124.8	91.9	+36
	July	18.5	16.3	+2.2	137.4	81.6	+68
	August	16.1	14.6	+1.5	158.6	66.8	+37
	September	10.1	9.3	+0.8	116.0	75.6	+53
	October	1.7	3.9	-2.2	85.4	64.6	+32
	November	-4.6	-5.5	+0.9	85.2	61.5	+36
	December	-17.3	-15.4	-1.9	37.2	38.8	-4

Appendix. North Central Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989.

Location	Host[a]	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[b]	Accumulated damage[c]
Atikokan District (15 locations)					
Agnes Lake	bF	28	666	S	6
Basswood Lake - Prairie Portage	bF	22	256	S	3
Burton Lake	bF	10	0	0	8
Cache Bay	bF	13	355	S	+
Clearwater West Lake	bF	26	157	M-S	5
French Lake	bF	57	362	S	5
Irene Lake	bF	48	622	S	3
Joe Lake	bF	12	67	M	8
Kawa Bay	bF	4	22	L-M	+
Little Eva Lake	bF	65	219	M-S	6
Lizard Lake	bF	68	587	S	5
Oriana Lake	bF	83	344	S	5
Poohbah Lake	bF	96	1329	S	5
Tuck Lake	bF	48	929	S	3
Van Nostrand Lake	bF	98	356	S	5
Geraldton District (19 locations)					
Ashmore Twp	bF	0	10	L	0
Caramat Rd - 2.8 km S. of Hwy 11	bF	1	64	M-S	0
Catlonite Rd - km 115.7	bF	2	137	M-S	0
- Spider Lake	bF	9	93	M-S	1
Goldfield Road - Kenogamisis R	bF	4	86	M-S	1
- Rogers Lake	bF	9	152	M-S	1
- Wig Lake	bF	8	79	M-S	1
Hwy 584 - Burrows Lake	bF	0	31	L-M	0
Industrial Rd - S. of Caramat	bF	0	31	L-M	0
Kimberly-Clark SPA[d]	wS	0	0	0	0
Klotz Lake Prov. Pk	bF	2	0	0	1
Long Lake - West	bF	4	429	S	1

(cont'd)

Appendix. North Central Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989 (cont'd).

Location	Host[a]	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[b]	Accumulated damage[c]
Geraldton District (concl.) (19 locations)					
Nakina Twp	bF	0	9	L	0
Nibs Lake - Impact Plot	bF	0	13	L	1
	wS	0	20	L-M	1
	bS	0	0	0	0
O'Meara Twp	wS	1	38	L-M	0
Pagwachuan Lake	bF	2	177	M-S	1
Wintering Lake	bF	41	655	S	1
Nipigon District (63 locations)					
Adamson Twp - Check Plot 7	bF	8	128	M-S	2
	wS	13	570	S	2
Barbara Lake	bF	34	289	S	2
Black Bay - Stand 3	bF	53	408	S	2
- Stand 45	bF	73	299	S	2
- Stand 51	bF	21	496	S	2
- Stand 63 - North	bF	68	734	S	2
- Stand 63 - South	bF	28	384	S	2
- Stand 66	bF	73	861	S	2
- Stand 93	bF	28	416	S	2
Booth Twp	bF	98	477	S	4
Camp 75 Rd	bF	9	35	L-M	1
Central Lake	bF	17	0	0	2
Cockeram Twp - Block 7, Plot 4[e]	bF	14	282	S	2
	wS	44	367	S	2
- Block 7, Plot 10[e]	bF	85	44	L-M	3
	wS	91	183	M-S	3
- Block 8, Plot 1[e]	bF	72	273	S	3
	wS	39	852	S	2
- Block 8, Plot 6[e]	bF	35	193	M-S	2
	wS	78	199	M-S	2

(cont'd)

Appendix. North Central Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989 (cont'd).

Location	Host[a]	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[b]	Accumulated damage[c]
Nipigon District (cont'd) (63 locations)					
Cockeram Twp (cont'd)					
- Block 9, Plot 1[e]	bF	8	106	M-S	2
	wS	66	175	M-S	2
- Block 9, Plot 10[e]	bF	56	122	M-S	3
	wS	87	415	S	3
- Block 10, Plot 3[e]	bF	8	57	M-S	3
	wS	44	549	S	3
- Block 10, Plot 6[e]	bF	22	52	L-M	3
	wS	70	105	M-S	3
Corrigal Twp	wS	85	1064	S	2
Hele Twp	bF	70	116	M-S	4
Hwy 527 - Gull River	bF	16	239	M-S	3
- Kopka River	bF	14	89	M-S	2
- Waweig Lake	bF	14	431	S	2
Innes Twp	bF	29	66	M-S	2
Kilkenny Twp	bF	1	0	0	0
- Lake Nipigon Prov. Pk	bF	22	681	S	1
	wS	23	4039	S	1
Ledger Twp	bF	98	159	M-S	2
Legault Twp	bF	2	17	L-M	1
Limestone Lake - km 9	wS	9	423	S	1
- km 15	wS	43	137	M-S	2
Nipigon Twp - Block 4, Plot 1[e]	bS	5	195	M-S	2
- Block 4, Plot 3[e]	bF	18	175	M-S	2
- Block 5, Plot 1[e]	bF	23	34	L-M	2
	bS	14	203	M-S	2
- Check Plot 4	bF	88	209	M-S	3
	bS	51	188	M-S	2
Onaman Lake	bF	1	0	0	0
Onaman River	bF	5	892	S	0
Oskawe Lake	bF	15	143	M-S	2
Parks Lake	bF	10	208	S	1
Patience Twp	bF	33	64	M	1

(cont'd)

Appendix. North Central Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989 (cont'd).

Location	Host[a]	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[b]	Accumulated damage[c]
Nipigon District (concl.) (63 locations)					
Polly Lake - Impact Plot	bF	90	869	S	2
	wS	99	2131	S	2
	bS	18	64	M-S	1
Purdom Twp - Block 2, Plot 1[e]	bF	10	74	M-S	2
	wS	83	541	S	3
- Block 3, Plot 1[e]	wS	7	52	M-S	2
- Check Plot 1	wS	26	253	S	3
Shillabeer Creek	bF	22	531	S	5
Summers Twp	bF	12	53	L-M	1
Upper Roslyn Lake	bF	61	118	M-S	2
Terrace Bay District (35 locations)					
Barbara Lake - SPA[d]	wS	0	11	L	0
Blue Jay Lake	bF	0	50	L-M	1
Cairngorm Lake	bF	65	154	M-S	2
Catlonite Rd - km 46.7	bF	49	228	S	1
Cirrus Lake	bF	8	89	M-S	1
Cornish Lake	bF	11	22	L-M	1
Dead Horse Creek Rd	bF	12	36	L-M	1
	wS	7	137	M-S	1
Deutzia Lake	bF	19	7	L	1
Ducell Lake	bF	97	753	S	2
Esker Lake	bF	36	54	L-M	1
Fakeloo Lake	bF	2	14	L	1
Foxtrap Lake	bF	1	28	L-M	0
Garnham Lake	bF	0	0	0	1
Gowan Lake	bF	0	18	L-M	3
Hwy 614 - Stand 360	bF	0	14	L-M	1
Ice Cream Lake	bF	2	0	0	0
Industrial and Camp 15 Rd	bF	1	11	L	0
Kagiano Lake	bF	2	115	M-S	0

(cont'd)

Appendix. North Central Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989 (cont'd).

Location	Host[a]	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[b]	Accumulated damage[c]
Terrace Bay District (concl.) (35 locations)					
Killala Lake	bF	1	21	L-M	1
Killraine Twp - Rainbow Falls Prov. Pk	bF	50	6	L	2
Leslie Twp	bF	1	0	0	0
Little Nama Creek	bF	0	0	0	0
McCoy Twp	bF	0	0	0	0
Morley Lake	bF	2	90	M-S	0
Neys Prov. Pk	bF	2	0	0	0
Pic Twp - Black River	wS	5	0	0	0
- Pukaskwa Pk Hdqtrs	bF	2	9	L	0
Portage Lake	wS	9	103	M-S	1
Rocke Lake	bF	12	46	L-M	1
Steel Lake	bF	9	195	M-S	1
Stevens - Microwave Tower	bF	0	0	0	1
Syine Twp	wS	13	38	L-M	0
Vein Lake	bF	3	30	L-M	1
Wiggins Twp	bF	67	20	L-M	2
Thunder Bay District (87 locations)					
Abitibi Price - Camp 230	bF	3	40	L-M	0
Aldina Twp					
- Impact Plot, Stand 4	bF	8	63	M	7
	bS	4	104	M-S	7
- Impact Plot, Stand 19	bF	9	141	M-S	8
Arrow Lake - Plot 1[e]	bF	10	0	0	4
	wS	69	450	S	4
- Plot 7[e]	bF	5	152	M-S	4
	wS	57	63	M	4
- Check Plot 1	bF	26	108	M-S	5
	wS	37	372	S	4

(cont'd)

Appendix. North Central Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989 (cont'd).

Location	Host[a]	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[b]	Accumulated damage[c]
Thunder Bay District (cont'd) (87 locations)					
Bedivere Lake - Block A, Plot 1[e]	bF	8	36	L-M	2
	wS	29	250	S	2
- Plot 2[e]	bF	5	34	L-M	2
	wS	8	73	M-S	2
- Block Z, Plot 1[e]	bF	29	55	M-S	2
- Block W, Plot 1[e]	wS	23	164	M-S	2
- Check Plot 1	bF	50	206	S	4
	wS	48	808	S	3
- Check Plot 4	bF	58	88	M-S	4
	wS	71	298	S	4
Blackwell Twp	bF	32	150	M-S	5
Bo Lake	bF	6	33	L-M	0
Burchell Lake - Stand 125	bF	2	0	0	8
- Stand 150	bS	0	0	0	0
Camp 45 Rd	bF	10	40	L-M	3
Cheeseman Lake - km 130	bF	21	548	S	5
	wS	32	647	S	5
	bS	10	196	M-S	5
Conacher Twp - Stand 459	bF	46	167	M-S	7
Crayfish Lake	bF	5	66	M-S	+
Devon Twp	bF	89	555	S	4
Dog Lake - North Bay	bF	8	57	M	9
Dorian Twp - Burkett Cove[f]	bF	62	48	L-M	2
Drift Lake Rd - Stand 279	bS	0	22	L-M	0
Forbes Twp - Flett	bF	18	16	L-M	3
Gorham Twp					
- Hazelwood[f]	bF	5	0	0	0
- Wishart[f]	bF	5	0	0	0
Greenwater Lake - Southeast	bF	1	143	M-S	-
- Shelter Island	bF	4	147	M-S	+
Greenwood Lake	bF	1	68	M	-
Grew River	bF	5	0	0	0
Hagey Twp - Hwy 586	bF	3	17	L-M	+
- Plantation	wS	3	50	L-M	1
Haines Twp - Postans	bF	7	0	0	+

(cont'd)

Appendix. North Central Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989 (cont'd).

Location	Host[a]	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[b]	Accumulated damage[c]
Thunder Bay District (cont'd) (87 locations)					
Harmon Lake	bF	20	182	M-S	2
Hicks Lake	bF	7	41	L-M	2
Hood Lake	bF	1	18	L-M	-
Hoof Lake	bF	4	143	M-S	+
Hwy 11					
- W. of 802, Stand 575	bS	1	22	L-M	9
- W. of 802, Stand 590	bF	1	0	0	9
- W. of 802, Stand 590	bS	0	11	L	9
- W. of 802, Stand 601	bF	5	0	0	9
- W. of 802, Stand 601	bS	0	0	0	9
Icarus Lake	bF	1	219	M-S	5
Kabitotikwia Lake	bF	76	269	S	4
Kekekoab Lake	bF	5	94	M-S	+
Lac des Mille Lacs					
- Bolton Bay	bF	21	344	S	3
- Honkonen Narrows	bF	60	567	S	4
Lismore Twp	bF	13	250	M-S	3
Matawin Rd					
- Tree Seed Orchard	wS	1	0	0	0
McGinnis Lake	bF	2	0	0	+
McMaster Twp	bF	41	367	S	2
	wS	38	942	S	2
Moraine Lake - west side	bF	100	622	S	4
Moss Lake	bF	4	115	M-S	-
Mountain Lake	bF	21	391	S	5
Mug Lake	bF	8	0	0	0
O'Connor Twp - Cedar Falls[f]	bF	11	17	L-M	0
- OMNR SPA[d]	wS	3	99	M-S	0
Paipoonge Twp - OMNR Nursery	wS	25	97	M-S	2
Pakashkan Lake - Outlet Bay	bF	12	53	L-M	0
Plummes Lake	bF	2	0	0	-
Sandstone Lake	bF	50	390	S	6
Savanne Twp	bF	7	94	M-S	2
Shebandowan Lake	bF	3	0	0	-

(cont'd)

Appendix. North Central Region - Spruce Budworm: Summary of defoliation estimates and egg-mass counts in 1988, and infestation forecasts for 1989 (concl.).

Location	Host[a]	Estimated defoliation in 1988 (%)	No. of egg masses per 9.29 m^2 of foliage	Infestation forecasts for 1989[b]	Accumulated damage[c]
Thunder Bay District (concl.) (87 locations)					
Sibley Prov. Pk	bF	16	88	M-S	1
	wS	23	1683	S	1
- Check Plot	bF	31	114	M-S	2
	wS	38	235	S	2
Squeers Lake	bF	4	0	0	-
Sump Lake	bF	4	32	L-M	5
Tib Lake	bF	7	35	L-M	0
Trewartha Twp	bF	10	53	L-M	1
Wawang Lake	bF	3	0	0	0
Weaver Lake	bF	45	212	M-S	2
Whitelily Lake - Hwy 527	bF	5	54	L-M	9
Wolf River Rd - km 28	bF	46	422	S	3

[a] bF = balsam fir, wS = white spruce, bS = black spruce

[b] S = severe, M = moderate, L = light, 0 = nil

[c] Accumulated Damage

Code	Categories
0	undamaged
1	light damage: < 25% total defoliation; usually one season of severe defoliation
2	moderate damage: 25% to 60% total defoliation; two or three seasons of severe defoliation
3	severe damage: 60% to 80% total defoliation; three to five seasons of severe defoliation; will recover
4	moribund or dying: 80% to 100% total defoliation; crowns grey in appearance, top dead or bare 50 cm to 150 cm
5	< 25% of stand dead
6	25% to 50% of stand dead
7	< 25% of stand dead; no significant (0-25%) defoliation for several years
8	> 70% of stand dead
9	< 25% of stand dead; no significant (0-25%) defoliation for several years
+	25% to 50% of stand dead; no significant defoliation for several years
-	51% to 70% of stand dead; no significant defoliation for several years

[d] SPA = Seed Production Area

[e] Aerially sprayed, B.t., 1988

[f] Lakehead Region Conservation Authority